Claims

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1. An optical waveguide comprising:
   a bottom boundary material;
   a precursor waveguide material deposited on the bottom boundary material, the precursor waveguide material formed from a two-component plasma reaction in a substantially air-evacuated plasma chamber, a first component of the two-component plasma reaction comprising a non-carbon containing and non-oxygenated silicon donor, and a second component of the two-component plasma reaction comprising a non-silicon containing and non-oxygenated organic precursor, the precursor waveguide material comprising:
      a waveguide core; and
      a side boundary material formed by selectively photo-oxidizing a region of the precursor waveguide material adjacent to the waveguide core by exposing the region of the precursor waveguide material to a radiated electromagnetic energy in the presence of oxygen to form the side boundaries of the waveguide core; and
   a top boundary material formed over the precursor waveguide material.

2. The optical waveguide of claim **1** wherein the second component of the two-component plasma reaction is selected from the group consisting of alkanes, alkenes, alkynes, phenyls and aromatic hydrocarbons.

3. The optical waveguide of claim **1** wherein the second component of the two-component plasma reaction is selected from the group consisting of ethylene, methane, ethane and toluene.

4. The optical waveguide of claim **1** wherein the first component of the two-component plasma reaction is selected from the group consisting of monosilane, disilane and dichlorsilane.

5. The optical waveguide of claim **4** wherein the second component of the two-component plasma reaction is selected from the group consisting of ethylene, methane, ethane and toluene.

6. A method of forming an optical waveguide comprising the steps of:

forming a bottom boundary material;

forming a precursor waveguide material on the bottom boundary material from a two-component plasma reaction in a substantially air-evacuated plasma chamber, a first component of the two-component plasma reaction comprising a non-carbon containing and non-oxygenated silicon donor, and a second component of the two-component plasma reaction comprising a non-silicon containing and non-oxygenated organic precursor;

selectively exposing at least one region of the precursor waveguide material to electromagnetic energy in the presence of oxygen to form an at least one photo-oxidized region in the precursor waveguide material; and

forming a top boundary layer material over the precursor waveguide material.

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7. The method of claim **6** wherein the at least one photo-oxidized region of the precursor waveguide material forms the side boundaries of a waveguide core in the non-photo-oxidized precursor waveguide material.

8. The method of claim **6** wherein the at least one photo-oxidized region of the precursor waveguide material forms a waveguide core.

9. The method of claim **6** wherein the second component of the two-component plasma reaction is selected from the group consisting of alkanes, alkenes, alkynes, phenyls and aromatic hydrocarbons.

10. The method of claim **6** wherein the second component of the two-component plasma reaction is selected from the group consisting of ethylene, methane, ethane and toluene.

11. The optical waveguide of claim **6** wherein the first component of the two-component plasma reaction is selected from the group consisting of monosilane, disilane and dichlorsilane.

12. The optical waveguide of claim **11** wherein the second component of the two-component plasma reaction is selected from the group consisting of ethylene, methane, ethane and toluene.

13. A vertically stacked, multiple waveguide core, plasma deposited waveguide structure comprising:

an at least two waveguide core layers, each of the at least two waveguide core layers formed from a two-component plasma reaction in a substantially air-evacuated plasma chamber, a first component of the two-component plasma reaction comprising a non-carbon containing and non-oxygenated silicon donor, and a second component of the two-component plasma reaction comprising a non-silicon containing and non-oxygenated organic precursor, wherein an at least one region of an each one of the at least two waveguide core layers is selectively photo-oxidized by exposing the at least one region to a radiated electromagnetic energy in the presence of oxygen, the at least two waveguide core layers arranged in a stack having a first layer and a last layer;

a barrier layer disposed between the each one of the at least two waveguide core layers, the barrier layer comprising a material for blocking transmission of the radiated electromagnetic energy;

a bottom boundary material disposed over the first layer of the at least two waveguide core layers, the bottom boundary layer forming a first end layer of the plasma deposited waveguide structure; and

a top boundary material disposed over the last layer of the at least two waveguide core layers, the top boundary material forming a second end layer of the plasma deposited waveguide structure, whereby a light signal is selectively guided through each of the at least two waveguide core layers.

14. A method of forming an optical element for the transmission of a light signal, the method comprising the steps of:

forming a base optical material from a two-component plasma reaction in a substantially air-evacuated plasma chamber, a first component of the two-component plasma reaction comprising a non-carbon containing and non-oxygenated silicon donor, and a second component of the two-component plasma reaction comprising a non-silicon containing and non-oxygenated organic precursor, the base optical material having a first index of refraction; and

selectively photo-oxidizing at least one region of the base optical material by exposing the base optical material to radiated electromagnetic energy in the presence of oxygen to form an at least one region of a photo-oxidized optical material having a second index of refraction, whereby the transmission of the light signal is selectively guided through the non-photo-oxidized base optical material and the at least one region of photo-oxidized optical material.

15. The method of claim **14** further comprising the steps of:

selectively guiding the transmission of the light signal through the non-photo-oxidized base optical material and the at least one region of photo-oxidized optical material; and

selectively photo-oxidizing the at least one region of the photo-oxidized optical material, responsive to the transmission of the light signal through the non-photo-oxidized base optical material and the at least one region of photo-oxidized optical material, to decrease the second index of refraction.

16. The optical waveguide of claim **14** wherein the second component of the two-component plasma reaction is selected from the group consisting of alkanes, alkenes, alkynes, phenyls and aromatic hydrocarbons.

17. The optical waveguide of claim **14** wherein the second component of the two-component plasma reaction is selected from the group consisting of ethylene, methane, ethane and

toluene.

18. The optical waveguide of claim **14** wherein the first component of the two-component plasma reaction is selected from the group consisting of monosilane, disilane and dichlorsilane.

19. The optical waveguide of claim **18** wherein the second component of the two-component plasma reaction is selected from the group consisting of ethylene, methane, ethane and toluene.